

## BULLETIN

Western's monthly energy efficiency and planning newsletter dedicated to customer activities and sharing information.

## NPPD VOLUNTEERS FOR CARBON CAPTURE DEMONSTRATION

**N**ebraska Public Power District (NPPD) is partnering with the University of North Dakota Energy and Environmental Research Center (EERC) on a \$19 million study of a new carbon dioxide (CO<sub>2</sub>) capture process.

In addition to NPPD and EERC, ION Engineering Inc. of Boulder, Colo., and the University of Alabama's Department of Chemical and Biological Engineering are also joining the project. DOE's Office of Fossil Energy is providing a \$15 million dollar grant to fund the project, with the partnership contributing \$4 million. NPPD is providing \$750,000 worth of in-kind services from its annual Operations and Maintenance budget.

**MOST LIKELY TO SUCCEED**

The demonstration project involves NPPD's Gerald Gentleman Station (GGS) in Sutherland, Neb., and technology developed by ION Engineering. "The GGS Unit 2 is located on the west side of the



NPPD's Gerald Gentleman Station in western Nebraska is testing a post-combustion solution for removing carbon dioxide from the exhaust stream. (Photo by Nebraska Public Power District)

state, closer to ION's headquarters in Colorado," said John Swanson, Generation Strategies manager with NPPD.

EERC's Partnership for CO<sub>2</sub> Capture (PCO<sub>2</sub>C) has explored two promising capture technologies: oxygen-fired combustion and post-combustion solvent-based absorption and stripping. Research indicated that advanced solvents, like one recently developed by ION Engineering, show great potential for lowering the cost of capture. According to company information, ION's second-generation solvent also has the advantage of using less water than the previous

iteration. NPPD, a PCO<sub>2</sub>C member, came forward to test the solvent in the real-world conditions of its coal-burning power plant.

Phase I of the three-phase demonstration project began in October, with the detailed design of the scrubber unit. Once installed, the equipment will divert less than one-half of a percent of the exhaust gas for carbon capture and then return it to the unit's exhaust stream. "This test is the next step up from laboratory testing on the way to commercial development, so only a very small amount of exhaust is needed," Swanson explained.

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# ROSEVILLE, CALIF., BUILDS SOLAR POWER PORTFOLIO

**T**he deadline for California's mandate to be powered by 33 percent renewable energy arrives in 2020, and municipal utilities like Roseville Electric are exploring all avenues for adding more renewables to their generation mix.

Recently, the city of Roseville signed a power purchase agreement (PPA) with First Solar Inc. for 32 megawatts (MW) of power from the Lost Hills photovoltaic plant. Construction on the small solar facility in Kern County, Calif., is expected to begin in early 2014.

At its peak, Lost Hills is expected to create up to 200 jobs and generate enough electricity to power more than 11,000 homes in its first year of operation. That clean, renewable energy will offset more than 20,000 metric tons of CO<sub>2</sub> annually, which is equivalent to taking about 4,000 cars off the road each year, and displacing over 18,000 metric tons of water consumption annually.

## PROVIDING FLEXIBILITY

Under the agreement the city council approved on July 17, the city will receive 100 percent of the solar

project's output from 2015 to 2019. When a separate PPA between First Solar and Pacific Gas and Electric goes into effect in 2019, Roseville's off-take will drop to 1 percent of the plant's output.

In other words, the utility's share of power from the project will drop significantly just as the renewables deadline arrives. But that's the opposite of a problem, said Power Supply Manager Mike Wardell. "Because it's a 10-year contract, [California Energy Commission] regulations allow us to spread the volume of power over the entire contract term," he explained. "It's like an energy bank account."

Wardell compared building a diverse renewables portfolio to putting together a jigsaw puzzle. "At the beginning, any corner will do, but as you work toward the center you have to pick and choose your pieces more carefully," he observed. "Third-party purchases give us crucial flexibility to get to the finished picture."

In addition to the First Solar PPA, Roseville signed a 10-year contract for base-load geothermal power, and has purchased wind and landfill gas. "We are progressively building our portfolio," said Wardell. "By the time we get to six purchases, Roseville will have met our goal."

## PROMOTING DG

PPAs are only one part of Roseville's strategy to build its renewable supply. Thanks to its long-term, proactive residential solar programs, Roseville ranks high among mid-sized cities in the state for solar installations per capita. "Almost 3 percent of our meters have solar arrays associated with them," said Electric Retail Services Supervisor Marty Bailey. "That penetration is one of the highest in the country."

About 90 percent of those systems are on homes built since Roseville launched its first solar incentive program in 1999. "The city was in a heavy growth mode around that time,



Thanks to solar incentives like Roseville Electric's BEST Homes program, 90 percent of the city's residential solar systems are on new energy-efficient homes. (Artwork by Roseville Electric)

and it is easier to design efficiency measures and renewable energy systems into new construction," Bailey pointed out. "It just made sense to focus our efforts on new home developments."

That early program has since evolved into BEST Homes, which encourages builders to incorporate energy-efficiency measures, such as high-efficiency air conditioners, into new homes, along with solar technology. Builders participating in the program currently receive \$.80 per watt for installing solar systems of 10 kilowatts or less, with larger systems rebated on a different schedule.

The city also offers rebates to residential and business customers who install grid-interconnected systems on existing buildings. The commercial sector has been slower to adopt solar power because the economics are not as favorable, Bailey acknowledged. "The price of solar systems has come down a lot in the last two years and we are seeing more activity on that side," he added. "We've seen businesses install four new systems over 100 kW just this year."

## FINISH LINE IN SIGHT

To date, Roseville boasts a total of 1,361 solar installations on homes and businesses. Combined with the PPAs,

*See SOLAR POWER PORTFOLIO, page 3*

## ENERGY SERVICES BULLETIN

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Editor: Kevon Storie  
Designer: Grant Kuhn



## Carbon capture *from page 1*

### BUSINESS AS USUAL

Because of the small scale of the testing, the project is not expected to have any effect on GGS operations. The project's physical footprint is small, using sectionalized pre-fabricated carbon dioxide capture equipment and modular offices for personnel and data management equipment. At the end of the demonstration in June 2017, the system will be removed and the plant returned to its original state.

ION Engineering and EERC staff will monitor the project and analyze test results. NPPD is providing only oversight and operational support for the facilities, and is acting as liaison with the Nebraska Department of Environmental Quality on permitting.

### FACING THE FUTURE

The partners' goals for the demonstration project are anything but small. DOE is striving to achieve a 90-percent CO<sub>2</sub> capture rate at an affordable cost by 2020, while ION's goal is to de-carbonize fossil fuel power generation at the lowest possible cost.

The public power utility is focused on how it will continue to provide reliable, affordable and environmentally safe energy to its customers as far out as 2032. Coal generation helps keep Nebraska's electricity rates among the lowest in the nation, but legislation restricting carbon emissions could change that. "Our long-term planning identifies carbon as an unknown risk," Swanson acknowledged. "We need to be investigating technologies that could help to control carbon capture costs at large fossil generating stations."

In fact, NPPD's integrated resource plan (IRP) identifies CO<sub>2</sub> cost assumptions and non-firm (energy) market price as major variables in its top scenarios. The possibility of adding long-term multi-pollutant control equipment at the Gerald Gentleman Station was included in the IRP, as was greater diversification of its energy resources.

With many options for managing emissions and the future of carbon regulation a question mark, NPPD is keeping its options open. And if blazing a trail for the power industry helps to keep electricity affordable, NPPD is ready to volunteer. ⚡

For links to more resources,  
visit <http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb1.aspx>

## Solar power portfolio *from page 2*

a few municipal solar arrays and other CEC-certified renewables, such as small hydropower, biomass and geothermal plants, Wardell estimates that Roseville is 30 to 40 percent of the way to meeting its goal.

As Wardell noted, the final

stretch will be trickier. "Our power purchases have bought us time, so we can evaluate different options," he said. "Every resource has different trade-offs and we have to decide which risks we want to accept and which ones have to be mitigated."

For a utility that has been performing that balancing act for years, meeting the state's goal in seven years isn't so intimidating after all. "It doesn't sound like much time," Wardell said. "But if we do something every year, it's pretty achievable." ⚡

For links to more resources,  
visit <http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb2.aspx>

# LOW-HANGING FRUIT STILL ON TREE

**E**nergy-efficiency advocates talk a lot about “low-hanging fruit”—the easy pickings of energy savings—usually in relation to one particular measure. It is certainly true that some equipment lends itself to relatively easy and inexpensive upgrades. But instead of counting on one or two programs to meet load management goals and customer needs, consider other flavors of “fruit” you might be missing.

## MEASURE FIRST

For all types of customers, if the complaint is high utility bills, an audit is the best way to identify the culprit and to introduce them to the rest of your energy-efficiency programs. Also, treating the building as a system makes it more likely that upgrades will improve energy performance, which may improve the chances of the customer investing in future efficiency measures.

Of course, audits don’t always (in fact, rarely) turn into customer action, but they are still useful to both consumer and power provider. For member services representatives, the audit is an invitation to educate customers about energy use on their own turf, answer their questions and remind them about simple measures and behavior changes that can add up to savings. For the auditor, it is the chance to learn about the type of building, and maybe even discover issues that are plaguing other customers. Most importantly, audits are a way to build your relationship with the customer, and that can translate into trust, cooperation and action further down the line.

## THE USUAL SUSPECTS

In addition to uncovering surprise opportunities, audits will undoubtedly highlight many common issues—there is a reason it is called low-hanging fruit, after all.

Lighting continues to be among the most cost-effective efficiency upgrades and one of the easiest to implement,



Industrial customers who want to go deeper to improve plant efficiency should check out the DOE Better Plant Partners Program. Partners can receive technical support, participate in training and get access to software tools and other energy analysis resources. Utilities can become partners too.

and it is everywhere. Thanks to policy changes and advancing technology, so are compact fluorescent lights (CFLs) and T-8 and T-5 fluorescent fixtures. That doesn’t mean that lighting programs are passé; rather, many utilities have moved on to prescriptive programs for larger customers.

Weatherization is a good investment for homeowners, and it pays off in comfort as well as lower heating and cooling bills. Sealing and insulating a home is more challenging than changing a light bulb, but this type of program can pay great dividends, especially for utilities serving lower-income areas. Helping homeowners to buy energy-efficient appliances when they need to replace an old unit is another tried and true way to reduce home energy use.

On the industrial side, motor-driven equipment, including pumps and fans, and compressed air systems offer great opportunities for manufacturers to reduce energy use. Upgrading large systems usually requires a significant investment by the customer, and occasionally, outside technical assistance. Fortunately, large industrial accounts can be among the most motivated customers when it comes to energy-efficiency improvements.

In institutional and non-industrial facilities, building controls can help energy managers get a handle on con-

sumption. A study by Pacific Northwest National Laboratories estimates that installing a handful of energy-efficiency controls on heating, ventilation and air conditioning (HVAC) systems could save U.S. commercial building owners an average of 38 percent on energy costs. Even simple products like occupancy sensors on lighting and programmable thermostats can make a significant dent in energy use, especially on buildings that have no existing energy management strategy.

Any business that has vending machines can reduce that constant load by installing a Vending Miser. These easy-to-install controls can reduce vending machine energy use by up to 46 percent. If you have a customer who is interested in test driving the Vending Miser, the Equipment Loan Program has two units available. Let your customers know that new and rebuilt Energy Star-qualified machines are available, too. It must be noted that the Vending Miser and energy-efficient vending machines do not necessarily reduce the utility’s peak demand, only the customer’s total energy use. So program managers must weigh the value to the end-user against their own load management goals.

## POTENTIAL WINNERS

Some measures don’t come with

*See LOW-HANGING FRUIT, page 7*





**A**s a significant component of the larger system, delivery ducts need to be taken into consideration when evaluating the overall performance of your heating, ventilation and cooling (HVAC) equipment. Energy Experts addresses some common questions about duct systems.

### QUESTION:

Is there any research showing energy savings resulting from cleaning a building's duct system? Does duct cleaning really improve indoor air quality (IAQ)?

### ANSWER:

Energy Experts has not found any research that definitively confirms or denies claims of energy savings from duct cleaning alone.

The Environmental Protection Agency (EPA) Indoor Air Quality website provides useful information on duct cleaning, but EPA studies have not substantiated energy-saving, nor health-related, benefits from the process. From the EPA publication, *Should You Have the Air Ducts in Your Home Cleaned?*:

"Some research suggests that cleaning heating and cooling system components (e.g., cooling coils, fans and heat exchangers) may improve the efficiency of your system, resulting in a longer operating life, as well as some energy and maintenance cost savings. However, little evidence exists that cleaning only the ducts will improve the efficiency of the system."

In a duct-cleaning study by the Canada Mortgage and Housing Corporation, researchers found that cleaning ducts did not significantly reduce the amount of energy the furnace fan used. Cleaning did not noticeably increase the supply or return air flow rates, either.



In a typical house, about 20 percent of the air that moves through the duct system is lost to leaks, holes and poorly connected ducts. A well designed and properly sealed duct system can make your home more comfortable, energy efficient and safer. (Photo by Anasazi Heating and Air)

### INDOOR AIR QUALITY

Contaminated ducts are in some cases the source of an IAQ problem, but often they have little if anything to do with the issue. Before investing in duct cleaning, get an assessment to determine the nature of the IAQ problem and whether dirty ducts really are the cause.

Over time, normal operation

deposits dust and other particulates in the ductwork. If left alone, these deposits may stay harmlessly in the ducts for years. However, cleaning or other system changes can disturb deposits and actually increase particulate counts immediately following maintenance. If particulates are the issue, improved filtration and

See ENERGY EXPERTS, page 8



WEBSITE OF THE MONTH:

## DOE EERE INDUSTRIAL DISTRIBUTED ENERGY

Recognizing the potential of combined-heat-and-power (CHP) systems to make our infrastructure smarter, stronger and more resilient, the Energy Department's Advanced Manufacturing Office (AMO) makes this technology a central component of its Industrial Distributed Energy program.

CHP captures waste heat from electricity generation to use for space and water heating and other processes. The systems use more of a fuel's energy content, making them far more cost-effective and cleaner than non-CHP systems. And since CHP systems are located near the point of consumption, they increase the electricity system's reliability and reduce transmission losses. According to the American Council for an Energy Efficient Economy, utilities can use the technology to control fuel costs, avoid or defer transmission system investments and increase system resiliency.

The AMO has been promoting the benefits of CHP to American businesses since 2003, and recently opened seven regional technical assistance partnerships. Located in California, Colorado, Illinois, New York, North Carolina, Pennsylvania and Washington state, these offices will provide end-users considering CHP at their facilities with technical assistance on project development from initial screening to installation.

### HERE TODAY, TOMORROW

CHP is an established technology in utility, commercial and industrial and institutional circles. CHP systems today represent 85 gigawatts—almost 9 percent—of the nation's total electricity capacity, and produced 506 billion kilowatt-hours of electricity in 2006.

Don't think "established" is the

same thing as "static," however. AMO is actively exploring novel energy-efficient, next-generation materials and innovative process technologies through research and development projects. A portfolio of CHP demonstrations focuses on high-value applications, fuel, systems and efficiencies. The site's project database lets visitors learn more about CHP projects in their state.

As the Industrial Distributed Energy program moves into its next decade, DOE anticipates that CHP can do much more for energy supply, reliability and the environment. The 2009 report, *CHP: A Decade of Progress, A Vision for the Future*, states that achieving 20 percent of U.S. generating capacity through CHP by 2030 would:

- Reduce annual energy consumption by 5,300 trillion Btu [British Thermal Units]
- Reduce CO<sub>2</sub> emissions equivalent to taking 154 million cars off the road
- Create 1 million jobs

Other publications available on the website highlight the results of specific applications and offer guidance on implementing systems at a variety of sites.

### IS CHP FOR YOU?

Long recognized as one of the low-hanging fruits of industrial efficiency,

CHP is not just for manufacturers. The list of CHP projects by market sector is a great refresher on the many applications for the technology. You may want to share the page with commercial customers and facility managers whose businesses are good candidates for CHP, but haven't considered it yet.

If they are interested, point them to Information Resources for a deeper understanding of the market, policies and issues surrounding implementation. Funding or incentives may be available to customers who are ready to make the move. Visit Legislative initiatives to keep up with policy changes that make could CHP systems in your area more feasible. In some states, for example, CHP and energy-efficiency advocates are pushing for rebates to extend beyond generated energy to offset energy from the systems.

In addition to connecting with customized assistance for their CHP projects, facility owners can find other types of support on the website. AMO counts federal and state agencies, non-governmental organizations, private clean energy companies, technology developers and commercial builders and developers among its partners. These resources will also be helpful to utility program managers who would like to add this versatile technology to their own program offerings. ⚡

U.S. DEPARTMENT OF  
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Energy Efficiency &  
Renewable Energy

## Industrial Distributed Energy

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visit <http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb5.aspx>

a lot of data to prove their load management value, but might make interesting pilot projects.

Window replacement usually has a long payback period and requires home ownership, so incentives for energy-efficient window coverings might be a better match for your customers' needs. Insulating cellular shades offer great thermal performance, especially in cold climates. Installing solar screens or awnings on south- and west-facing windows can reduce cooling needs. Window films have come a long way, allowing in more visible light while reducing solar heat gain and filtering out furnishing-damaging ultraviolet rays.

Miscellaneous electrical loads—the “vampire” loads appliances and electronics continue to draw as long as they are plugged in—are a growing problem. According to Energy Star, the average U.S. household spends \$100 per year to power devices while they are in standby mode. Nationally, standby power accounts for more than 100 billion kilowatt-hours of annual electricity consumption and more than \$10 billion in annual energy costs. Advanced power strips, which detect when the end-use appliance is not in use and automatically shut off, may offer an answer. There is not yet much documentation on the cost-effectiveness of this technology for load reduction. Utilities with large residential customer bases (the average home has about 40 plug loads) might want to explore a pilot program.

High-efficiency HVAC equipment is a proven performer for

energy-efficiency programs, but replacement is almost entirely opportunity-based. You can wait for customers to upgrade their systems, or you can help them get a better performance out of their existing units with an air filter replacement program. Reminding homeowners to wash or change their filters regularly can reap health benefits and modest energy savings, and lengthen the life of the equipment. It is also a good way to get your residential customers to turn to you when it is time for the new furnace.

For industrial HVAC systems, facility managers may feel that they have to choose between air quality and energy efficiency. However, a new generation of synthetic-fiber filters shows promise for delivering high-efficiency filtration without affecting fan energy use significantly. Carefully matching the choice of filter to the system can help to minimize energy loss, as well. Some manufacturers now produce “sustainable,” low-energy filters that they claim can significantly reduce the HVAC system's energy use. Although these products have not yet been independently tested, the fact that the issue of energy use is on the industry's radar is encouraging.

### EVERY ONE A SNOWFLAKE

Don't overlook the measures that are specific to a particular industry as you develop demand-side management and conservation programs.

Grocery stores consume 30 percent of their energy for refrigeration alone, so incorporating efficient cooling system components

can really pay off for a business that is critical to the community. All types of retail customers are good candidates for prescriptive lighting programs.

If your service territory includes resorts and recreation facilities, work with these accounts to increase water-heating efficiency. Combined heat and power (CHP) systems (website of the month) can benefit hotels, restaurants, recreations centers and spas, or any type of business that uses large amounts of heat for operations.

Agricultural customers can gain efficiencies by replacing old irrigation pump motors with premium-efficiency motors and retrofitting existing motors with variable-speed drives for modulating motor speed. Refrigeration upgrades and CHP systems can also be good investments for this sector, especially where food processing is part of the operation.

### GET THE LADDER

As the recommendations here indicate, low-hanging fruit depends on factors like climate, customer base and building stock, to name only a few. You may have to stretch past the tried-and-true measures to find that successful program, or you may have to wait for customer outreach to ripen into action.

If you have a pet customer program that helped you to solve a load management issue, share it with Energy Services Bulletin. We are always on the lookout for stories of initiative and innovation. ⚡

For links to more resources,  
visit <http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb3.aspx>

source containment are usually a better long-term strategy.

If ducts have been contaminated by flooding, plumbing leaks or spills, or you find evidence of mold growth, pests or vermin, they should be cleaned immediately. Moisture combined with dust and dirt provides a medium for biological growth and toxins that could spread throughout the system.

### SYSTEM MAINTENANCE

Whether or not duct cleaning is called for, HVAC systems do need regular maintenance. Cleaning exchanger coils and drip pans, and changing filters as needed, will save energy and lengthen the life of the system.

### QUESTION:

Do you have information comparing the cost of duct sealing and testing with mastic versus aerosol sealants? This is for a small commercial building.

### ANSWER:

Both hand-applied mastic and aerosol sealants have been shown to be very effective at sealing leaky duct systems. When properly applied, the longevity of the seal in both cases should equal the life expectancy of the system.

Many variables affect the cost of duct sealing—accessibility of the ducts, experience level of the technician and local market conditions are a few. If the ducts are easily accessible, hand sealing with mastic will usually be more cost effective. If the ducts are not easily accessible, the higher costs

of aerosol sealing may be justified, and in fact may be the only way to get a reasonably tight distribution system. Aerosol sealing is a proprietary process and is only available from franchised dealers, which can affect costs.

Aerosol-Based Duct Sealing for Residential and Commercial Buildings, from the E3T Energy Efficiency Emerging Technologies Database, is a collection of practical, commercially available, but not-yet-widely-used duct-sealing technologies that are being reviewed and evaluated by energy experts and engineers.

### QUESTION:

Do coatings work to protect older fiberglass HVAC ducts that are beginning to deteriorate and, in some cases, show signs of mildew growth?

### ANSWER:

Some coatings available for fiberglass duct board put a durable surface coating on the fiberglass, and some actually get absorbed by the duct board. Both have the ability to extend the life of the duct board, but applying a coating to fiberglass HVAC ducts that are beginning to deteriorate or have signs of mold growth is not recommended.

A Washington State University Extension Energy Program indoor air quality (IAQ) expert, who also provides technical support in the region for the EPA, does not recommend duct coatings as a cover-up for potential IAQ problems. If the duct board shows signs of dirt and moisture, identify

the source of the contamination and eliminate it by replacing those sections. Once fiberglass duct liner is contaminated with mold, cleaning is not sufficient to prevent re-growth, and there are no EPA-registered biocides for the treatment of porous duct materials. The EPA, National Air Duct Cleaners Association and the North American Insulation Manufacturers Association all recommend replacing wet or moldy fiberglass duct material.

### ADDITIONAL INFORMATION

- U.S. National Institutes of Health  
*Fact Sheet on HVAC Duct Cleaning*
- Indoor Air, 2010 December  
*Is ventilation duct cleaning useful? A review of the scientific evidence*
- University of California Indoor Air Quality Work Group  
*Hazards/Problems Associated with Fiberglass Duct Liner and HVAC Insulation* ⚡

For links to more resources,  
visit <http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb4.aspx>